Electronic TUBES

# 5840
# PENTODE
**Five-Star Tube**
★ ★ ★ ★ ★

**FOR WIDE-BAND HIGH-FREQUENCY AMPLIFIER APPLICATIONS**

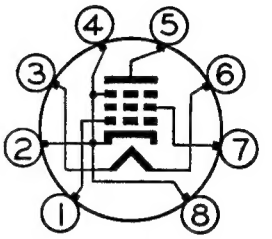
**8-LEAD SUBMINIATURE**
**SHARP-CUTOFF CHARACTERISTIC**
**SHOCK, VIBRATION RATINGS**
**HEATER-CYCLING RATING**
**HIGH TRANSCONDUCTANCE**

## DESCRIPTION AND RATING

The 5840 is a subminiature sharp-cutoff pentode for use in high-frequency circuits.

The 5840 is a special-quality tube for use in critical industrial and military applications where operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

### BASING DIAGRAM




RETMA 8DL

### TERMINAL CONNECTIONS

Lead 1—Grid Number 1
Lead 2—Cathode and Grid Number 3
Lead 3—Heater
Lead 4—Cathode and Grid Number 3
Lead 5—Plate
Lead 6—Heater
Lead 7—Grid Number 2 (Screen)
Lead 8—Cathode and Grid Number 3

## GENERAL

### ELECTRICAL

Cathode—Coated Unipotential

| | | |
|---|---|---|
| Heater Voltage, AC or DC | 6.3 ± 5% | Volts |
| Heater Current | 0.15 | Amperes |

Direct Interelectrode Capacitances

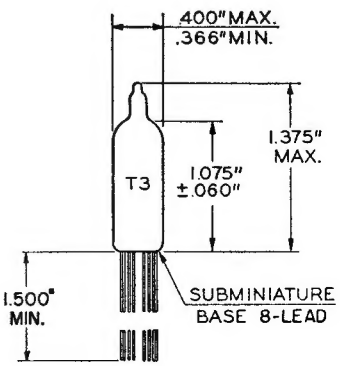
| | With Shield* | Without Shield | |
|---|---|---|---|
| Grid-Number 1 to Plate, maximum | 0.015 | 0.03 | μμf |
| Input | 4.2 | 4.0 | μμf |
| Output | 3.4 | 1.9 | μμf |

*With external shield of 0.405-inch inside diameter connected to cathode.

### MECHANICAL

Mounting Position—Any
Envelope—T-3, Glass
Base—E8-10, Subminiature Button 8-Lead

### PHYSICAL DIMENSIONS




RETMA 3-1

GENERAL ELECTRIC

*Supersedes ET-T1096 dated 8-54*

## MAXIMUM RATINGS

### ABSOLUTE MAXIMUM VALUES

| | | |
|---|---|---|
| Plate Voltage | 165 | Volts |
| Screen Voltage | 155 | Volts |
| Negative DC Grid-Number 1 Voltage | 55 | Volts |
| Plate Dissipation | 0.8 | Watts |
| Screen Dissipation | 0.35 | Watts |
| DC Cathode Current | 16.5 | Milliamperes |
| Heater-Cathode Voltage | | |
| Heater Positive with Respect to Cathode | 200 | Volts |
| Heater Negative with Respect to Cathode | 200 | Volts |
| Bulb Temperature at Hottest Point | 220 | C |

## CHARACTERISTICS AND TYPICAL OPERATION

### CLASS $A_1$ AMPLIFIER

| | | |
|---|---|---|
| Plate Voltage | 100 | Volts |
| Screen Voltage | 100 | Volts |
| Cathode-Bias Resistor | 150 | Ohms |
| Plate Resistance, approximate | 0.26 | Megohms |
| Transconductance | 5000 | Micromhos |
| Plate Current | 7.5 | Milliamperes |
| Screen Current | 2.4 | Milliamperes |
| Grid-Number 1 Voltage, approximate | | |
| Ib = 10 Microamperes | −9.0 | Volts |

## CLASS A RESISTANCE-COUPLED AMPLIFIER

LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)

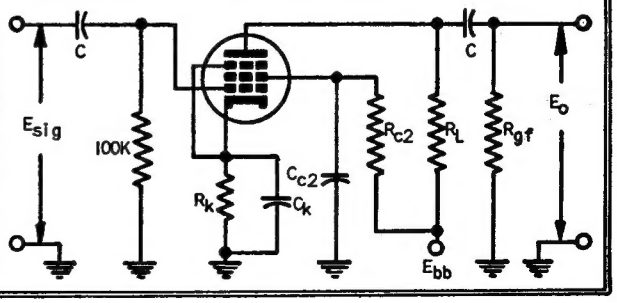
| $R_L$ | $R_{gf}$ | Ebb = 90 Volts | | | | Ebb = 150 Volts | | | | Ebb = 225 Volts | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $R_k$ | $R_{c2}$ | $E_o$ | Gain | $R_k$ | $R_{c2}$ | $E_o$ | Gain | $R_k$ | $R_{c2}$ | $E_o$ | Gain |
| 0.10 | 0.10 | 1000 | 0.2 | 13 | 50 | 500 | 0.3 | 19 | 83 | 400 | 0.3 | 29 | 110 |
| 0.10 | 0.24 | 1000 | 0.2 | 16 | 73 | 500 | 0.3 | 25 | 120 | 400 | 0.3 | 38 | 160 |
| 0.24 | 0.24 | 1700 | 0.5 | 13 | 72 | 1500 | 0.6 | 20 | 100 | 700 | 0.8 | 29 | 160 |
| 0.24 | 0.51 | 2000 | 0.6 | 15 | 89 | 1500 | 0.7 | 24 | 140 | 700 | 0.9 | 35 | 210 |
| 0.51 | 0.51 | 2500 | 1.3 | 11 | 93 | 2000 | 1.5 | 18 | 140 | 1000 | 1.7 | 28 | 200 |
| 0.51 | 1.0 | 3000 | 1.5 | 13 | 110 | 2000 | 1.7 | 20 | 180 | 1000 | 2.0 | 31 | 260 |

HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)

| $R_L$ | $R_{gf}$ | Ebb = 90 Volts | | | | Ebb = 150 Volts | | | | Ebb = 225 Volts | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $R_k$ | $R_{c2}$ | $E_o$ | Gain | $R_k$ | $R_{c2}$ | $E_o$ | Gain | $R_k$ | $R_{c2}$ | $E_o$ | Gain |
| 0.10 | 0.10 | 1200 | 0.2 | 13 | 48 | 700 | 0.2 | 18 | 77 | 500 | 0.3 | 28 | 110 |
| 0.10 | 0.24 | 1300 | 0.2 | 16 | 70 | 800 | 0.3 | 24 | 110 | 500 | 0.3 | 37 | 150 |
| 0.24 | 0.24 | 2800 | 0.4 | 12 | 68 | 1700 | 0.6 | 20 | 100 | 1200 | 0.8 | 29 | 150 |
| 0.24 | 0.51 | 3000 | 0.5 | 15 | 82 | 1800 | 0.7 | 24 | 140 | 1300 | 0.8 | 35 | 190 |
| 0.51 | 0.51 | 5500 | 1.0 | 11 | 76 | 3500 | 1.3 | 18 | 120 | 2400 | 1.6 | 26 | 180 |
| 0.51 | 1.0 | 6200 | 1.2 | 12 | 92 | 3800 | 1.6 | 19 | 160 | 2500 | 1.8 | 31 | 230 |

Notes:

1. $E_o$ is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS
3. $R_k$ is in ohms; $R_{c2}$, $R_L$, and $R_{gf}$ are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. $R_k$ and $R_{c2}$ should be adequately by-passed.



## CHARACTERISTICS LIMITS

| | | Minimum | Maximum | |
|---|---|---|---|---|
| **Heater Current** | | | | |
| Ef = 6.3 volts | Initial | 140 | 160 | Milliamperes |
| | 500-Hr | 138 | 164 | Milliamperes |
| **Plate Current** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed) | Initial | 5.5 | 9.5 | Milliamperes |
| **Screen Current** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed) | Initial | 1.5 | 3.3 | Milliamperes |
| **Transconductance (1)** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 Ohms (by-passed) | Initial | 4200 | 5800 | Micromhos |
| **Transconductance Change with Heater Voltage** | | | | |
| Difference between Transconductance (1) and Transconductance at Ef = 5.7 volts (other conditions the same) expressed as a percentage of Transconductance (1) | Initial | .... | 10 | Percent |
| | 500-Hr | .... | 15 | Percent |
| **Transconductance Change with Operation** | | | | |
| Difference between Transconductance (1) initially and after operation expressed as a percentage of initial value | 500-Hr | .... | 20 | Percent |
| **Average Transconductance Change with Operation** | | | | |
| Average of values for "Transconductance Change with Operation" | 500-Hr | .... | 15 | Percent |
| **Plate Resistance** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed) | Initial | 0.175 | .... | Megohms |
| **Plate Current Cutoff** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Ec1 = −9.0 volts | Initial | .... | 50 | Microamperes |
| **Interelectrode Capacitances** | | | | |
| Grid-Number 1 to Plate (g1 to p) | Initial | .... | 0.015 | μμf |
| Input (g1 to h, k, g2, g3) | Initial | 3.5 | 4.9 | μμf |
| Output (p to h, k, g2, g3) | Initial | 2.9 | 3.9 | μμf |
| Measured with external shield of 0.405-inch inside diameter connected to cathode. | | | | |
| **Negative Grid-Number 1 Current** | | | | |
| Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), Rg1 = 1.0 meg | Initial | .... | 0.3 | Microamperes |
| | 500-Hr | .... | 0.8 | Microamperes |
| **Heater-Cathode Leakage Current** | | | | |
| Ef = 6.3 volts, Ehk = 100 volts, | | | | |
| Heater Positive with Respect to Cathode | Initial | .... | 5.0 | Microamperes |
| | 500-Hr | .... | 10 | Microamperes |
| Heater Negative with Respect to Cathode | Initial | .... | 5.0 | Microamperes |
| | 500-Hr | .... | 10 | Microamperes |
| **Interelectrode Leakage Resistance** | | | | |
| Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that no cathode emission results | | | | |
| Grid-Number 1 to All at 100 Volts DC | Initial | 100 | .... | Megohms |
| | 500-Hr | 50 | .... | Megohms |
| Plate to All at 300 Volts DC | Initial | 100 | .... | Megohms |
| | 500-Hr | 50 | .... | Megohms |
| **Vibrational Noise Output Voltage RMS** | | | | |
| Ef = 6.3 volts, Ebb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms (by-passed), $R_L$ = 10,000 ohms, Vibrational acceleration = 15 G at 40 cps | Initial | .... | 60 | Millivolts |
| **Grid-Number 1 Emission Current** | | | | |
| Ef = 7.5 volts, Eb = 100 volts, Ec2 = 100 volts, Ecc1 = −9.0 volts, Rg1 = 1.0 meg | Initial | .... | 0.5 | Microamperes |

The indicated 500-hour values are life-test end points for the following conditions of operation: Ef = 6.3 volts, Eb = 100 volts, Ec2 = 100 volts, Rk = 150 ohms, Rg1 = 1.0 meg, Ehk = 200 volts with heater positive with respect to cathode, and bulb temperature = 220 C minimum.

## SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

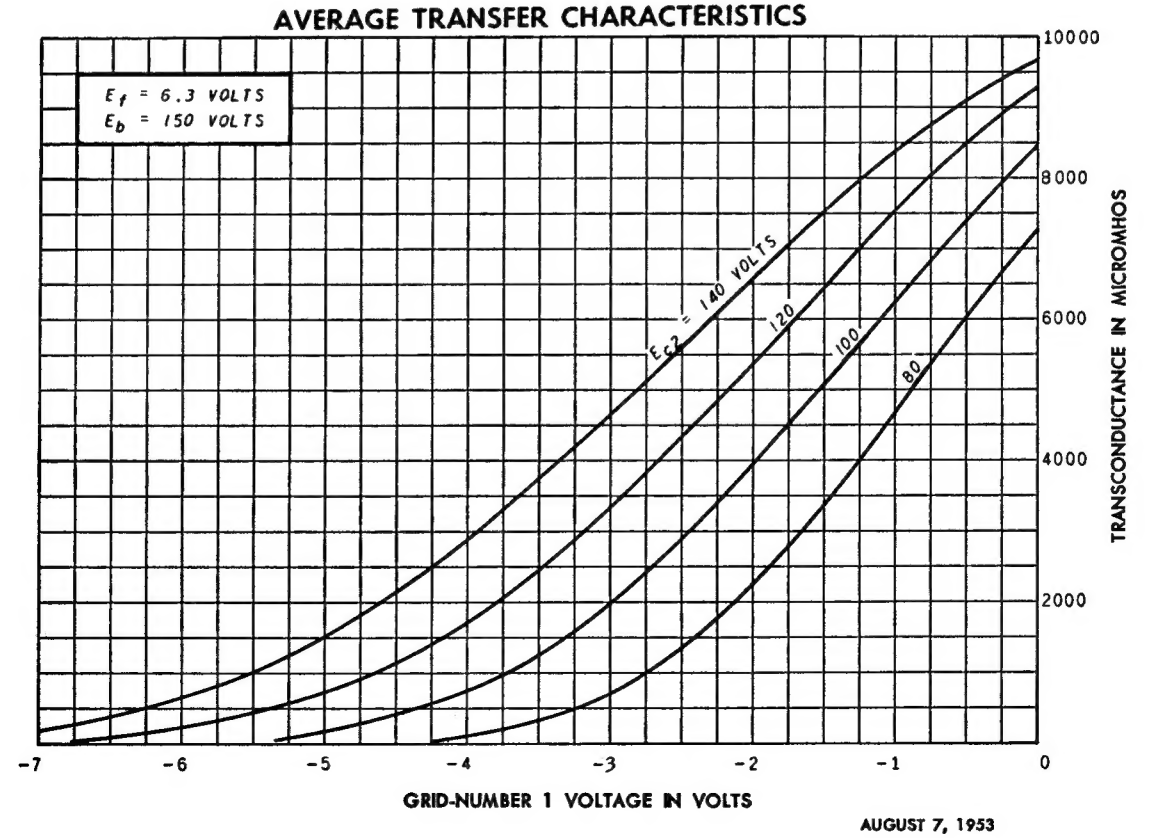
Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and four minutes off, Eb = Ec2 = Ec1 = 0 volts, and Ehk = 140 volts RMS.

Shock Rating—450 G
Statistical sample subjected to five impact accelerations of 450 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

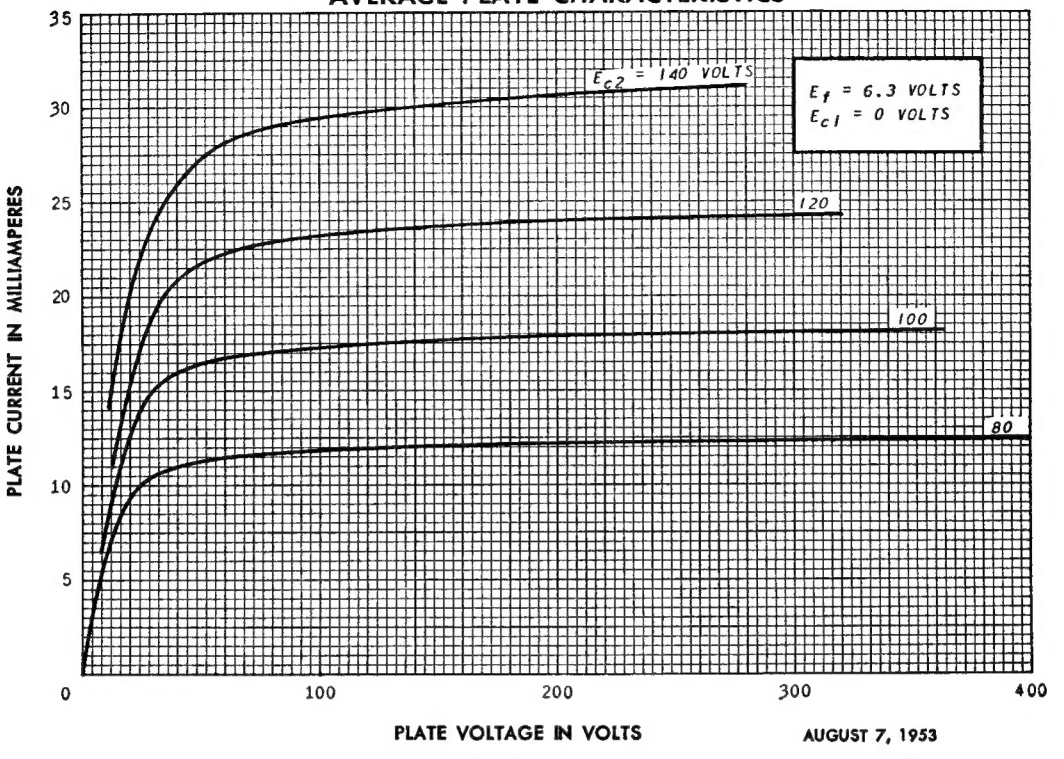
Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.
In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1 specification.



## AVERAGE PLATE CHARACTERISTICS

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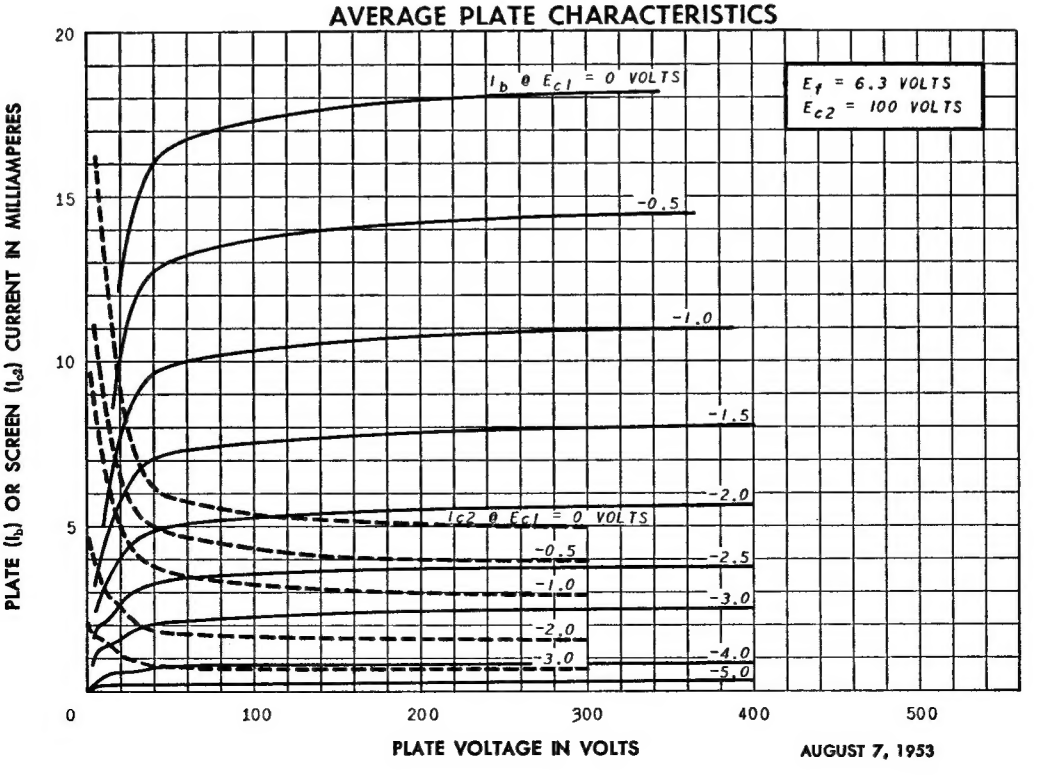
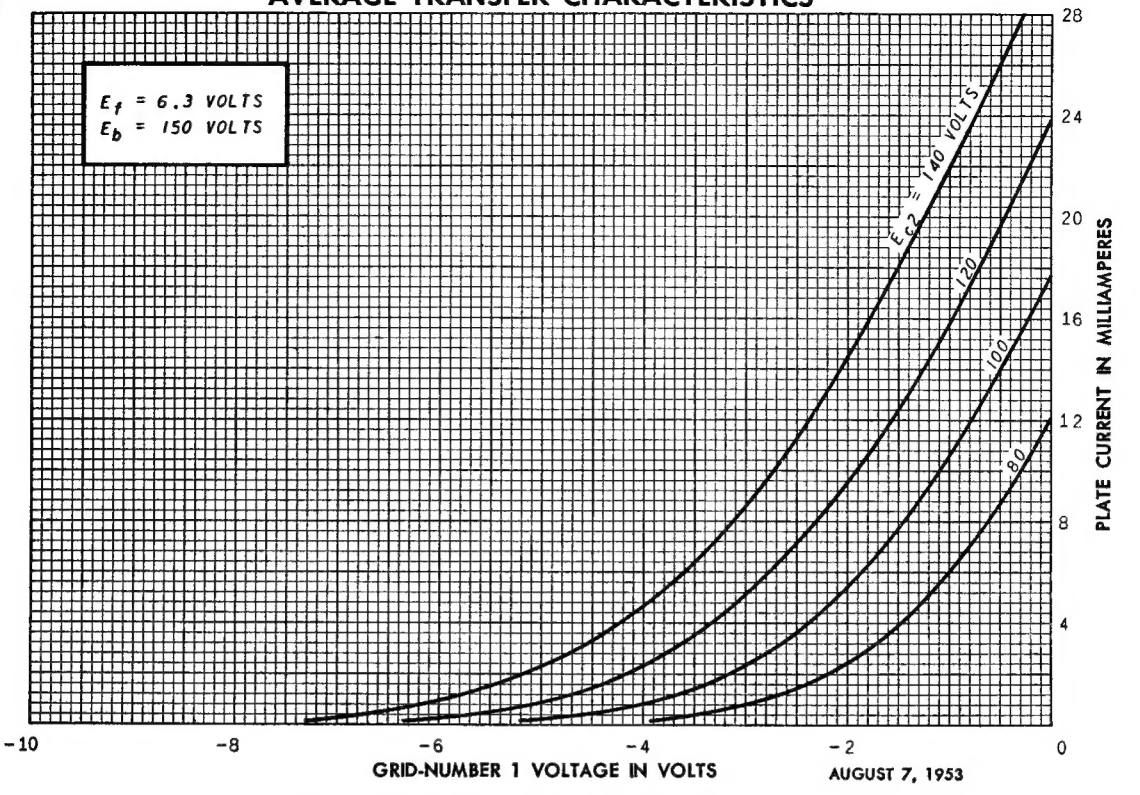
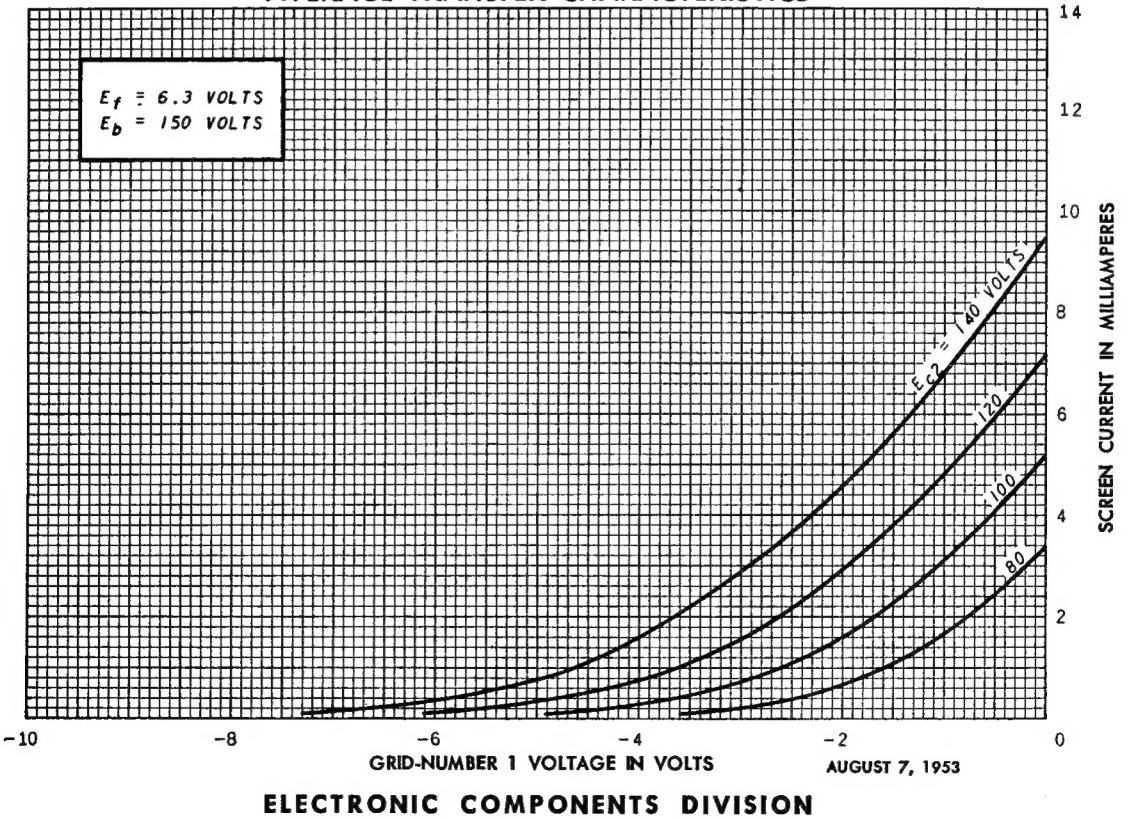


## AVERAGE TRANSFER CHARACTERISTICS




## AVERAGE TRANSFER CHARACTERISTICS




**ELECTRONIC COMPONENTS DIVISION**

**GENERAL ELECTRIC**

**Schenectady 5, N. Y.**